STRATEGY RESEARCH PROJECT

TELEMEDICINE TECHNOLOGY: WILL IT ENHANCE COMBAT CASUALTY CARE ON THE 21ST CENTURY BATTLEFIELD?

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ABSTRACT

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To meet the challenges of the future with less resources, the Army Medical Department (AMEDD) is pursuing a re-engineering initiatives which takes advantage of newly emerging informational technologies. The AMEDD expects to leverage these technologies in the form of telemedicine to improve combat casualty care on the 21st century battlefield. This paper briefly reviews the changes occurring in the AMEDD, explores whether its telemedicine concepts and initiatives will enhance future combat casualty care and examines the potential implications of introducing new technologies to the combat heath support system.

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Introduction

America's Army has undergone tremendous change since the end of the Cold War. It witnessed a significant downsizing of the force, closure of many bases/facilities and a reduction in its forward presence. All facets of the Army were affected to include the Army Medical Department(AMEDD).

To meet the challenges of the future with less resources, the Army has embraced a change initiative called Force XXI. Force XXI is a vision of the Army of the next century.[1,2] This vision incorporates rapidly emerging technologies which are expected to greatly enhance the lethality and survivability of U.S. ground forces. The AMEDD is actively involved in the Army's change process. Through a major re-engineering initiative, the AMEDD also expects to take advantage of technological advancements to improve its ability to provide combat casualty care on the 21st century battlefield.

A major part of this re-engineering effort is Telemedicine. By leveraging newly developed informational technologies and pursuing telemedicine concepts and initiatives, the AMEDD expects to enhance far forward combat healthcare delivery.

This paper briefly reviews the changes occurring in the AMEDD, explores whether its telemedicine concepts and initiatives will enhance casualty care on the 21st century battlefield and examines the potential implications of introducing new technologies to the combat health support system.

A Changing Army and AMEDD

Over the 200 years of its existence, the United States Army has seen many changes. It has repeatedly grown in size for war and has cyclically drawn down after conflicts have ended. With the fall of the Berlin Wall and the end of the Cold War against the Soviet Union, the major threat to US national interests had vanished. As history would predict, another reduction in the size of U.S. military forces was in order.

Since 1989, the Army has drawn down its military and civilian personnel strength by one third, approximately 450,000 people. It witnessed a 40% reduction in its budget and the closure of approximately 650 installations/facilities. As a result, the Army transitioned from a forward deployed force to a power projection Army.[3]

Like the rest of the Army, the Army Medical Department (AMEDD) also downsized significantly in the 1990s. But in the

process, it restructured itself for the future and laid a foundation for a medical force which it hopes will meet the challenges of the next century. Most important are the AMEDD's initiatives to improve combat casualty care through innovative re-design of field hospitals, modernization of evacuation assets and the leveraging of new and emerging information technologies to enhance survivability of the battlefield wounded.

Despite a smaller medical force, the AMEDD remains committed to accomplishing its wartime mission of "Preserving the Fighting Strength".[4] Whether the AMEDD's initiatives to enhance combat casualty care in the future will meet its own objectives of: saving lives; evacuating casualties from the battlefield; reducing the incidence of disease and non-battle injury; examining, treating and returning to duty as far forward as possible; is yet to be determined.[5]

AMEDD Downsizing and Restructuring. From 1988 to 1997, the AMEDD personnel strength declined 31% and its world wide medical treatment facilities (MTFs) dropped from a total of 47 in 1989 to 36 in 1996.[6,7] In spite of these tremendous changes, the AMEDD held steady and began an effort to re-engineer itself to better support the total Army force.

The AMEDD launched a major restructuring campaign in 1992 which led to the activation of the US Army Medical Command (MEDCOM) at Fort Sam Houston, Texas in October of 1994.[8,9] This new organization replaced the 21 year old Health Services Command. The Surgeon General became dual-hatted as the MEDCOM Commander while remaining the Army Chief of Staff's principal medical staff advisor. MTFs were grouped under seven Health Service Support Areas, now called Regional Medical Commands (RMCs), to coordinate healthcare across CONUS, Hawaii and Europe. These RMCs also accepted responsibility for ensuring medical readiness across their regions to include integrating training with the Reserve Components. Readiness for the Reserve Components is imperative since 70% of the deployable medical strength resides there. Accompanying the restructuring was a significant reduction in staff and a streamlining of command and control. The innovative changes which occurred in the 1990s in the AMEDD were recognized by the former Army Chief of Staff, GEN Sullivan, when he stated in 1994, "the MEDCOM is the first Force XXI Major Army Command".[10]

Medical Re-Engineering Initiative. Along with the AMEDD's reorganization is an aggressive re-engineering effort to support Force XXI called the Medical Re-Engineering Initiative (MRI).[11,12]

Its initiatives encompass the ability to tailor field medical units for any operation, maximizing their flexibility and deployability with a reduced battlefield footprint and the utilization of advanced technology across the healthcare continuum. In addition, MRI is expected to cut the size of the TO&E force and exploit technology to do more with fewer medical soldiers.

MRI calls for the present four field hospital types to be reduced to one robust 248-bed facility which will be capable of breaking out a 84-bed component for split team operations. The fully mobile 84-bed component is also designed to be used as an early entry medical facility. Outpatient resources will be added to the new hospitals and tailored specialty detachments can be added to increase its healthcare capability. Forward Surgical Teams (FSTs) will replace MASH hospitals by attaching themselves to brigade medical companies thus putting surgical capability far forward on the battlefield.

A new armored ambulance along with a medical version of the Blackhawk, the UH-60Q helicopter, hope to be placed in the acquisition cycle soon. Both will have improved treatment capability, enhanced operational mobility and modernized communication equipment.

Taking advantage of emerging informational technologies is a priority under MRI. The AMEDD believes that by improving medical situational awareness and the linkages between the injured soldier, healthcare providers and diagnostic systems through medical advanced technologies, combat casualty care can be enhanced in almost any operation.

Telemedicine

In the words of the AMEDD's recent Surgeon General, LTG Alcide M. La Noue, "the information age has spawned a revolution in the field of medicine-particularly Army Medicine".[13] Although the revolution in Army medicine is at its early stages, it has already shown capability for extending healthcare beyond traditional boundaries.

At the core of medicine's revolution is Telemedicine. It can be defined as the utilization of advanced informational technologies to project the delivery of medical services over time and space. Telemedicine has demonstrated its potential over the past three years in providing real world medical support both in the United States and in such diverse areas as Saudi Arabia, Kuwait, Somalia, Haiti, Cuba, Panama, Croatia and Macedonia.[14] The harnessing of this new type of information technology to

advance healthcare is only really beginning to take off in the AMEDD.

At the lead of the AMEDD's telemedicine effort is the Medical Advanced Technology Office (MATMO), a subordinate element of the US Army Medical Research and Material Command at Fort Detrick, Maryland.[15,16] MATMO operates a telemedicine test bed whose goal is to exploit emerging informational technologies for the advancement of telemedicine. MATMO coordinates telemedicine development and activities with other DOD agencies to include the Defense Information Systems Agency, the Defense Advanced Research Projects Agency, the AMEDD Center and School Battle Laboratory, and various other defense industry and medical organizations.

The AMEDD is pursuing multiple advanced technology concepts and initiatives which it believes have potential for enhancing combat casualty care. These initiatives are presently being tested in Army War Fighting Exercises(AWEs) and real life military operations. Before addressing the telemedicine concepts and initiatives, a review of the present system of combat health support is in order to be understand where telemedicine is expected to fit in.

Combat Health Service Support

Combat Health Service Support is configured in echelons of medical care which extend from the forward edge of the battlefield to the CONUS sustaining base(Figure 1).[17]

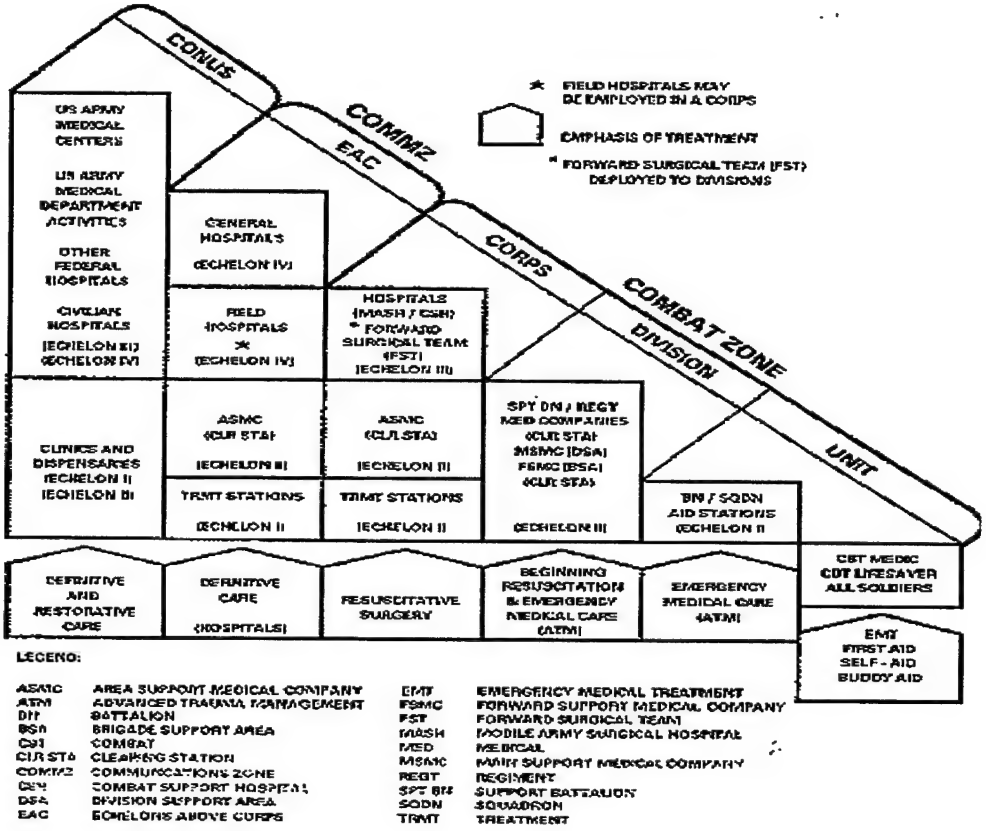

Figure 1

Each higher echelon of care provides an increased medical capability while retaining the capabilities of the lower or preceding echelon.

Initial care is provided by the individual soldier through self aid or by a fellow soldier, buddy-aid. All soldiers learn

the basics of first aid during basic training and sustain these skills through routine common task training.

Augmenting the self and buddy-aid is the combat life saver. The combat life saver is a non-medical member of a tactical unit who has received additional first aid training to include the ability to start intravenous fluids. The primary duty of the combat life saver does not change, but with advanced first aid skills, he can provide enhanced care for combat related injuries before the combat medic arrives.

Echelon I medical treatment is provided by combat medics and a physician or physician assistant(PA) of the Battalion Aid Station (BAS). Far forward emergency medical treatment is delivered by combat medics. Casualties requiring care beyond the capability of the combat medic are evacuated to the BAS. The physician or PA at the BAS is trained to provide advanced trauma management in addition to routine sick-call procedures. Emphasis is placed on treating soldiers so that they can return to duty (RTD) or stabilizing them for evacuation to a higher echelon of care.

Echelon II medical care is provided by medical clearing stations operated by medical companies located in the Brigade Support Areas(BSA), Division Support Area(DSA), Corps Support

Area(CSA), and the Communication Zone(COMMZ). Emergency medical and resuscitative care is provided by physicians and medics. Patients can be held up to 72 hours for treatment in medical clearing stations before returning them to duty. Patients with medical conditions or injuries which require treatment exceeding the capability of the clearing station medical staff or are likely to require greater than 72 hours of convalescence before they can RTD are evacuated to a Echelon III or IV facility.

Echelon II clearing stations can be augmented by Forward Surgical Teams(FSTs) so that early resuscitative surgery can be provided for seriously wounded or injured soldiers forward on the battlefield. Presently each Airborne and Air Assault division has these teams organic to their main support medical companies in the DSA.

Echelon III and IV care is provided by field hospitals which are staffed and equipped to care for all categories of patients. Mobile Army Surgical Hospitals(MASH) are normally deployed forward in the DSA along side the division clearing stations. Combat Support Hospitals(CSH)in the CSA and the General Hospitals in the COMMZ.

Echelon V care is provided by Army Medical Centers in CONUS and have full capability for the treatment and rehabilitation of all categories of patients.

Evacuation of casualties generally flow from the lowest echelon of care to the higher echelon. This is accomplished by ground and air evacuation medical assets. Casualties requiring expertise at a higher echelon of care, are often times evacuated by medical air assets from the site of injury directly to the closest field hospital.

Telemedicine Concepts

The AMEDD hopes to improve its ability to provide combat health support by pursuing advanced technology initiatives which support the telemedicine concepts of telemonitoring, telementoring, and teleconsultation.[18,19]

Telemonitoring. Identifying the wounded or injured soldier on the battlefield is paramount if prompt medical attention is to be rendered. The concept of telemonitoring involves the use of advanced information technology to monitor the physiologic status and location of the individual soldier on the battlefield. If a monitored soldier receives a wound/injury which alters his vital

signs, medical personnel would immediately be aware and therefore be able to expedite medical care.

The Warfighter Personnel Status Monitor (WPSM) is the medical advanced technology initiative which the AMEDD is pursuing to support the telemonitoring concept.[20,21,22] The WPSM is a proposed wrist-watch like device which would combine advanced environmental and physiological sensors with a computer processor, geopositioning receiver and low-power wireless radio. This device, to be worn by soldiers in combat, would monitortheir vital signs and location. Use of the WPSM would enable commanders and medical personnel to know the exact location and medical status of each soldier on the battlefield.

The WPSM is felt to have the potential to reduce combat deaths by potentially reducing fratricide, enhancing early treatment and medical evacuation and by detecting chemical and biological warfare agents. The WPSM sensors would also inform the medic of those casualties who have already died therefore negating the requirement for evacuation assets to enter a dangerous environment.

Besides use on the battlefield, the AMEDD feels that the WPSM will have great utility in high risk training. Certain

activities in Ranger and Special Operating Forces Training would benefit by the monitoring of individual soldiers.

The WPSM will be tied into the Land Warrior System being developed by the Infantry Center and School. This computerized system is designed to give the combat soldier battlefield situational awareness. Both the WPSM and the Land Warrior System prototypes are still several years out before being fielded.

Telementoring. Combat medics provide far forward medical care with very little supervision during combat operations. They treat casualties to the best ability of their training and evacuate patients with medical conditions exceeding their scope of care to physicians and PAs at BASs, medical clearing stations, or hospitals. The telementoring concept refers to the real time communication between the combat medic and the physician or physician assistant located at the BAS. This active communication facilitates a mentoring process which ultimately projects greater medical expertise farther forward on the battlefield. The presumption is that both the casualty and the combat medic will benefit by the coaching and observation by the physician or PA mentor.

The telementoring concept proposes that combat medics be equipped with lightweight, hands free, FM radios capable of

secure voice communication and small, lightweight, portable video cameras (medic-cam) to project digital video images.[23] The AMEDD believes that the combat medic, utilizing these technologies, can be effectively mentored by physicians and PA's to make a more accurate diagnosis, provide a greater degree of medical care, and perform a more rapid triage of casualties.

The hands free radios and prototypes of the medic-cams are presently available technologies and have been utilized and tested by medics in the field along with a concept vehicle, the Mobile Medical Mentoring Vehicle (M3V) which simulates the future BAS treatment vehicle. The M3V is a modified, high mobility, multipurpose, wheeled vehicle with a lightweight modular shelter mounted in its rear cargo area.[24] It contains FM radio systems, computers, and video monitors, which enable the PA or physician to communicate effectively with his far forward medics. High technology communication systems are also present which enable the physician or PA to transmit voice/video/data information to a higher echelon of care.

Teleconsultation. Teleconsultation is the process of real-time digital voice/video/data communication between one healthcare provider in a distant location with another, usually at a higher echelon of care, in order to obtain advise or information to aid

in the care of a patient. Using digitizing cameras, computers, radios, and satellite communication systems, this telemedicine concept process proposes to facilitate collaboration between medical specialists at hospitals or medical centers with physicians or PA's at remote sites. The transmission of a wounded soldier's medical record, x-rays and other studies, along with real-time voice/video communication between the patient, his treating physician, and the distant consultant, would enable high level specialty care to be projected almost anywhere. The teleconsultation concept enables expert specialty care to be provided far forward on the battlefield and is expected to actually decrease the number of medical specialists required in the theater of operations. It also proposes to reduce the number of casualties which need to be evacuated rearward for specialty consultation.

Physicians and PA's at Echelon I BAS utilizing digitized voice/video/data capability present in their treatment vehicles would be able to consult with physicians at their supporting echelon II Medical Clearing Stations through a dedicated communication network. Physicians at clearing stations in-turn could consult with specialty physicians at field hospitals or distant medical centers using similar voice/video/data systems

via satellite communication connections. X-rays and EKG's from remote sites could be sent for interpretation negating the need for radiologists and cardiologists to be present in the field. Diagnostic scope sets would enable the transmission of still images and video of close examination of the eyes, ears, nose, throat, skin, and the gastrointestinal system. The teleconsultation concept has been validated in numerous field demonstrations and in real world contingencies.

On the cutting edge of teleconsultation is telesurgery.[25,26] This concept entails the projection of a medical center based surgeon into the operating room of a distant field hospital. Through global telecommunications, the remote surgeon will be able to manipulate instruments in the surgical field at a combat hospital utilizing robotic technology. A prototype of a telesurgery system has been successfully demonstrated in simulated field exercises using a central surgical work station and a remote surgical instrument manipulator. Three dimensional cameras, stereophonic sound transmitters, and tactile feedback from the remote surgical instrument manipulator would give the consulting surgeon the feeling of presence in the operating room. This system would enable expert medical center surgical

specialists to bring their expertise to casualties in combat hospitals anywhere in the world.

Will Telemedicine technologies enhance combat casualty care on the 21st century battlefield?

The telemedicine concepts just described appear to hold promise in enhancing combat casualty care and increasing the survivability of soldiers who sustain wounds/injuries on the battlefield. Before pursuing the important question as to whether telemedicine technologies will enhance combat casualty care on the 21st century battlefield, a review of the historical profile of casualties needs to be presented.

Profile of Battlefield Casualties. Combat, by its nature, implies the loss of personnel. With very few exceptions there will be attrition of personnel whether it be in actual combat or in operations other than war.

Personnel losses have generally been divided into three major categories: enemy action, accidents, and illness. Enemy action causes casualties through wounding by bullets and high velocity fragments from mines, bombs, rockets, artillery and mortar shells. Mass casualties can also be caused by NBC weapon systems. Accidents occur more frequently in war and result in

injured soldiers. Illness/disease, which limits the performance of service members, is present in any environment and will contribute to the loss of personnel strength. An additional cause of personnel losses is fratracide. Due to the "Fog of War", victims of "friendly fire" are present in every conflict.

Personnel losses are categorized as battle casualties and Disease/Non-Battle Injury (DNBI). There are three types of battle causalities: Killed in Action (KIA), Wounded in Action (WIA), and Captured/Missing in Action (CMIA). KIA's die of wounds prior to receiving medical attention and WIA's are casualties who are alive when they enter the medical system. WIA casualties who die after receiving medical attention are classified as having died of wounds (DOW). CMIA's are losses which do not enter the combat health system unless recovered. DNBI losses include those caused by disease, mental illness, and injuries due to accidents.

History tells us that approximately 20% of battle casualties are killed in action.[27,28] This appears to be a constant percentage during U.S. wars of the past 150 years. Studies of soldiers killed in action during the Vietnam conflict indicate that 50% of them died from blood loss and that an estimated that 20% of these casualties could have been saved if simple first aid measures to stop bleeding were immediately instituted.[29]

Analysis of war wound data indicate that approximately 67% of those killed in action in the Vietnam Conflict died within ten minutes of wounding.[30] Once a WIA casualty enters a medical treatment facility the DOW rate is approximately 2% given the medical expertise equivalent to what was present in Vietnam.[31] Return to duty rates of battle and DNBI casualties are generally estimated at 75% over 20 days with 25% being evacuated out of theater and 2-3% dying of wounds.[32]

Having briefly reviewed what history tells us of the nature of combat casualties, the question of whether the AMEDD's telemedicine concepts and supporting technology initiatives will enhance future combat casualty care can be addressed. A reasonable approach to answering this question would be to examine the telemedicine concepts and initiatives against the doctrinally based combat health support objectives: save lives on the battlefield; evacuation of casualties; reduce the incidence if DNBI; treat and return to duty as far forward as possible; mentioned previously at the beginning of this paper.

Save Lives on the Battlefield. Knowing historically that 20% of combat casualties are KIA and that there are only 2-3% or less DOW's, focusing medical efforts on reducing the number of KIA's

makes sense. The AMEDD is attempting to do this via telemonitoring by the WPSM initiative and telementoring.

Telemonitoring of soldiers engaged in combat by the WPSM would appear to give medical personnel unprecedented awareness of the need for medical care by wounded soldiers and their location. If combat medics were in a position to provide care for the most seriously injured casualties within 10 minutes, then using historical data, 67% of these casualties who normally die within this time period would still be alive to receive resuscitation. Knowing also the real-time vital signs of all casualties by use of the WPSM, the medic could potentially perform remote triage and attend to the casualties who would most benefit by his skills. Telemonitoring by physicians and PA's could also greatly assist the combat medic in both triage and the treatment of the seriously wounded.

Realistically though, the combat medic could not possibly provide effective emergency medical treatment to all seriously wounded casualties, especially if they occurred simultaneously. The time needed to stop hemorrhage, bandage wounds, start IV's, and begin resuscitative fluids for one seriously injured casualty is quite extensive and therefore limits the medic's ability to attend to others. On the other hand, by knowing the physiologic

status and precise location of the seriously wounded casualties via the WPSM, the medic could immediately call for assistance of nearby combat life savers, other combat medics and evacuation teams.

The use of the WPSM theoretically could also reduce KIA's through avoiding fratracide.[33] Fratracide accounts for 10 to 15% of all casualties. In Desert Storm, 24% of the KIAs and 15% of the WIAs were due to "friendly fire".[34] Unit commanders, having shared awareness of the location of their soldiers using data from the WPSM, could lessen the risk of sending fires their way.

Considering the potential of the WPSM, it is reasonable to deduce that its application would result in a greater number of lives saved after wounding.

Evacuation of Casualties. If the WPSM performs as expected, the evacuation of casualties most likely will be expedited due to the increased awareness of the battlefield wounded. An additional effect of the WSPM is the probability that casualties of a more critical nature will need to be evacuated rearward. This poses an increased risk for enroute demise of seriously wounded casualties since medical care during battlefield evacuation is very difficult.

The AMEDD is dealing with the issue of enroute care through the development of a medical evacuation platform called the LSTAT (Life Support for Trauma and Transport).[35,36] This self-contained evacuation pod will be independently powered to provide critical care modalities normally present only in intensive care units. The LSTAT is expected to provide patient monitoring and life stabilizing therapies to severely wounded soldiers who would not likely survive evacuation otherwise. It will be suitable for use in both air and ground evacuation assets to include long-haul fixed wing aircraft. As of March 1997, four pre-production prototypes have been delivered to the AMEDD for testing.

The use of the WPSM along with the LSTAT does show promise in enhancing the evacuation and survivability of casualties.

Reduce the incidence of DNBI. The incidence of DNBI, during conflict, has been constantly decreasing since WWI.[37] The DNBI rate for the most recent U.S. high intensity conflict, Desert Shield/Storm, was the lowest ever recorded.[38] Command emphasis on preventive medicine paid off in this conflict. The use of advanced medical technology would aid in the dissemination of information regarding disease and injury prevention, but realistically, would not have a significant impact since rates

are already low and expect to be the same in future combat operations.

Examining, treating and returning to duty as far forward as possible. If the WPSM and telementoring concept come to fruition, the combat medic's ability to find and treat combat casualties at or near the site of wounding would appear to be enhanced. The WPSM would effectively locate the wounded soldiers for the medic and telementoring technology would enable physicians/PAs to give advice as needed. Since casualties generally do not occur in isolation, the WPSM would enable the combat medic to triage multiple wounded soldiers remotely in order that he attend to those who would most benefit by his lifesaving efforts.

One can also presume that the telementoring of combat medics by their BAS physicians/PAs will aid in the triage, diagnosis and treatment of casualties. But will the far forward medic use the mentoring capability of advanced technology? AWEs at the Joint Readiness Training Center(JRTC) in February 1996 and the National Training Center(NTC) in March 1997 revealed that the use of telementoring by combat medics tended to decrease as the number of casualties increased.[39,40] It appears that when attending to multiple casualties, time was a constraining factor in the telementoring process. The effort required of the medic to

quickly diagnose, treat and arrange for evacuation of multiple casualties limited his ability to communicate with his mentor. Conversely, when casualties were low, telementoring was more apt to occur. The same AWEs demonstrated that telementoring was also limited by high mobility operations and when the medic's unit was under enemy fire. It is probably reasonable to assume that with medics gaining more experience with telementoring, its use will increase in all situations.

Knowing the capability of telementoring and teleconsultation it appears that these concepts hold promise in returning soldiers to duty as far forward as possible. The evacuation of patients who require only an opinion or recommendation by a medical/surgical specialist can reasonably be avoided through teleconsultation. Teleconsultation has already been demonstrated to prevent evacuation of patients for specialty care in world-wide contingency/peacekeeping operations. The same would likely occur in an active war zone. It also seems reasonable that the telementoring of combat medics during company sick-call would reduce the number of soldiers coming rearward to the BAS for care.

If telesurgery technology becomes a reality, the projection of high level surgical expertise to the combat zone

would avoid risky evacuation of the critically wounded to out of theater hospitals for emergency surgical care. Although telesurgery would not significantly return soldiers to duty, it has the potential to reduce those patients who die from their wounds.

Overall, it appears that the AMEDD's telemedicine concepts and supporting technology initiatives will meet its battlefield objectives, and in turn, also enhance its capability to provide combat casualty care in the future. The AMEDD still has a considerable way to go in making telemedicine a significant part of its combat health support operations. As development continues, several implications of its future institution become apparent.

Implications

Costs. Telemedicine technologies will come with a significant monetary cost. Considering that every soldier engaged in combat operations will wear a WPSM, that each combat medic will need to be fitted with telemonitoring and telementoring equipment and that teleconsultation technologies would be required from echelon I to echelon V of the combat health support system, the costs associated with these technologies will most likely be in

the multi-billion dollar range. With computer technologies advancing every 18 months or so, upgrading existing systems will also be financially challenging for the AMEDD. Significant additional expenditures will be needed for personnel, training, technical support and equipment maintenance.

Where will the AMEDD obtain the resources to implement telemedicine initiatives? Pressure is already being felt to reduce the AMEDD's force structure and facilities, as it is through out the Army, in order to fund modernization programs. Most likely the AMEDD will be forced to further reduce the number of its hospitals and medical centers. It will likely maintain its go to war capability at the cost of peacetime care to its beneficiaries. As a result, access to healthcare for non-active duty will be increasingly limited in Army medical treatment facilities and the Department of Defense's newly instituted managed healthcare system, TRICARE, will likely bear more payments to the civilian contractors whose medical care is more expensive.

There is also every indication, that short of war, the U.S. Congress will continue to reduce funding for the military services. Future budgets for military healthcare will be affected as a result. Will the AMEDD be forced to jointly operate

peacetime hospitals with the other services to preserve battlefield medical capability, telemedicine initiatives and other combat modernization programs? Will there be movement toward a joint medical command for further savings? Will the AMEDD embed field hospitals in certain fixed stateside medical treatment facilities as is the case with overseas hospitals to save personnel costs? These and other actions are presently being discussed by AMEDD senior leaders to deal with future healthcare budget constraints. No doubt, the costs of telemedicine combat initiatives will be one of the driving forces for the AMEDD to change as it enters the twenty-first century.

Personnel. The AMEDD will need the best and brightest soldiers to become combat medics in the next century. More will be required of the eighteen to nineteen year old medic to provide far forward casualty care. The combat medic will not only have to process far greater information but will need enhanced medical skills in order to take advantage of telemonitoring and telementoring.

Where will the AMEDD get these young quality soldiers when the educational level of recruits enlisting in the Army is declining? How will the AMEDD retain medics who have additional skills that are marketable outside the military? Increased

benefits and quality of life inducements would help, but also would add additional costs to an already declining medical budget.

Another concern on the personnel side is the retention of experienced physicians. If the AMEDD limits non-active duty healthcare and becomes more operational or active duty focused in order to fund modernization efforts, many unobligated physicians may leave active military service in order to practice their well earned medical specialties. Caring only for the active duty soldiers holds very little interest with the majority of Army doctors. Active duty personnel are generally a healthy population and do not have the medical conditions conducive to physicians maintaining their skills. Retaining high quality medical professionals to care for the Army's finest will be a significant issue if the AMEDD downsizes further for the sake of modernization.

Training. The institution of advanced medical technologies into the combat health support system will have a significant impact on training at all levels in the AMEDD. It will prolong both initial and sustainment training for both officers and enlisted.

Besides training which focuses primarily on the new advanced technologies, the combat medic will require additional medical

competencies to maximize the impact of telementoring. The medic of the future will be expected to have greater diagnostic and procedural skills in order to treat more seriously injured casualties. This requirement will significantly extend medical advanced individual training and involve a greater commitment of time to maintain these additional competencies through sustainment training. As critical as these skills are, testing for certification of competency will need to be conducted on a regular basis.

There is little doubt that additional training will require greater personnel and monetary resources. Paying for these resources with expected smaller healthcare budgets will be another challenge for the AMEDD.

Enhanced training requirements also have the potential to affect peacetime access to care for medical beneficiaries. With more personnel being involved in readiness training, hospital and clinic appointments for patient care will most likely be less. This possibly could lead to more patients receiving care from the more expensive TRICARE civilian network.

Technical Support. It is almost a certainty that greater technical support will be required to maintain the operational effectiveness of computerized telemedicine equipment. Considering

the complexity of this type of technology, this support will likely come from civilian industry consultants at a significant cost to the AMEDD.

Conclusion

The Army Medical Department has undergone immense change during the 1990s due to the Army's downsizing and also as a result of its preparation for the challenges of the 21st century. Its re-engineering initiatives which encompass telemedicine battlefield concepts and technologies show great potential in enhancing far forward combat casualty care.

Leveraging advanced medical technologies to move forward the concepts of telemonitoring, telementoring and teleconsultation, the AMEDD hopes to save more lives on the battlefield, expedite patient evacuation and enhance the treatment and the return to duty of soldiers as far forward as possible. After examining the historical profile of combat casualties and the potential that telemedicine technologies offer, it is apparent that combat casualty care will be enhanced if these technologies come to fruition.

The potential implications of the future employment of telemedicine battlefield technologies to the combat health

support system appear daunting but are probably not insurmountable. They will challenge the leadership of the AMEDD well into the next century. The right decisions will need to made for the sake of the soldiers who expect the best combat casualty care. There is no question that the AMEDD will change as a result and be far different than we know it today.

ENDNOTES

[1]GEN William W. Hartzog and Susan Canady, "Creating Army XXI," ARMY, October 1996, 53.

[2]GEN Dennis J. Reimer, "The U.S. Army: 'The World's Premier Force'," ARMY, October 1996, 22.

[3]GEN Dennis J. Reimer, "Soldiers are our Credentials," Military Review, October 1995, 13.

[4]U.S. Department of the Army, "Health Service Support in a Theater of Operations," FM 8-10, 1 March 1991, 1-1.

[5]Ibid., 1-8.

[6]LTG Alcide M. LaNoue, "Army Drawdown ," DCA Conference Briefing Slides, 29 November 1995.

[7]Ibid., "Status of U.S. Army Medical Treatment Facilities," briefing slide.

[8]"The MEDCOM," The Mercury, special issue, Fall 1996.

[9]LTG Alcide M. LaNoue, "Army Medicine:'Caring Beyond the Call of Duty'," ARMY, October 1996, 152.

[10]Ibid, 152.

[11]"Medical Re-Engineering Initiative," AMEDD Center & School Briefing, September 1995.

[12]"Medical Reengineering Initiative prepares AMEDD to serve next-generation Army," The Mercury, September 1996.

[13]LaNoue, "Army Medicine: 'Caring Beyond the Call of Duty'," 151-152.

[14]Dean E. Calcagni, et.al., "Operation Joint Endeavor in Bosnia: Telemedicine Systems and Case reports," Telemedicine Journal,vol. 2 no. 3, 1996.

[15]F. Clifton Berry Jr., "Army leads the Telemedicine Revolution," ARMY , September 1995, 43.

[16]"DoD Telemedicine," available from http://www.matmo.org; Internet; accessed 14 March 1997.

[17]Department of the Army, "The Medical Company," FM 8-10-1, 29 December 1994, 1-1-1-5.

[18]BG Russ Zajtchuk and GEN Gordon R. Sullivan, "Battlefield Trauma Care: Focus on Advanced Technology," Military Medicine, January 1995, 4-6.

[19]"Telementoring/Teleconsultation Force XXI," AMEDDC&S Battle Lab Home Page, available from http://www.acs.amedd.army.mil; Internet; accessed 14 March 1997.

[20]Zajtchuk, 3.

[21]LTC Bernard DeKoning, "Warfighter Physiologic Status Monitor," Information Paper and Briefing Slides, AMEDDC&S DCCD, 23 February 1997.

[22]"Personnel Status Monitor System," Defense Sciences Office, Defense Advanced Research Projects Agency, available from http://www.sainc.com/arpa/abmt/index.htm; Internet, accessed 14 March 1997.

[23]"Telementoring/Teleconsultation".

[24]"Mobile Medical Mentoring Vehicle (M3V)," DoD Telemedicine-MATMO Projects, available from http://www.matmo.org/pages/m3v.html; Internet, accessed 14 March 1996.

[25]Zajtchuk, 6.

[26]"Human Factors in Tele-Inspection and Tele-Surgery," Defense Sciences Office, Defense Advanced Researh Projects Agency, available from http://www.sainc.com/arpa/abmt/mithuman.htm; Internet, accessed 14 March 1997.

[27]Trevor N. Dupuy, Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War (Fairfax: Hero Books, 1990), 51.

[28]Zajtchuk, 1.

[29]COL Ronald F. Bellamy, "The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research," Military Medicine, February 1984, 60

[30]Zajtchuk, 2.

[31]Bellamy, 59.

[32]Dupuy, 53.

[33]Kenneth K. Steinweg, "Dealing Realistically with Fratricide," Parameters, xxv, no. 1 Spring 1995, 26.

[34]Department of Defense, "Desert Storm," Final Report to Congress, appendix M, 592-594.

[35]Scott R. Gourley, "LSTAT Will Save Lives," ARMY, March 1997, 25-26.

[36]"Life Support for Trauma and Transport (LSTAT)," Defense Science Office, Defense Advanced Research Projects Agency, available from http:www.sainc.com/arpa/abmt/lstat.htm; Internet: accessed 14 March 1997.

[37]Dupuy, 51, 54.

[38]"Medicine in the Gulf War," U.S. Medicine, vol 27, no.s. 15&16, August 1991,6.

[39]U.S. Army Medical Department Board, "Advanced Warfighting Experiment of Telemedcine (9602)," Force Development Evaluation Report, February 1996, v,vii,viii.

[40]CPT Bruce Chahbaz of the U.S. Army Medical Deparment Board, telephone interview,
14 April 1997.

BIBLIOGRAPHY

Bellamy, COL Ronald F. "The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research." Military Medicine 149 (February 1994): 55-64.

Berry, F.Clifton, Jr. "Army Leads the Telemedicine Revolution." ARMY (September 1995): 38-46.

Bzik, COL Karl D. and Bellamy, COL Ronald F. "Editorial: A Note on Combat Casualty Statistics." Military Medicine 149 (April 1984): 229-232.

Cacagni, Dean E.,et.al "Operation Joint Endeavor in Bosnia: Telemedicine Systems and Case Reports," Telemedicine Journal 2 no. 3 (1996).

Chahbaz, CPT Bruce, U.S. Army Medical Department Board, telephone interview by author, 14 April 1997.

DeKoning, LTC Bernard. "Warfighter Physiologic Monitor (WPSM)." Information Paper and Briefing Slides, AMEDDC&S (23 February 1997).

"DoD Telemedicine," available from http://www.matmo.org; Internet; accessed 14 March 1997.

Dupuy, Trevor N. Attrition: Forecasting Battle Casualties and Wa Equipment Losses in Modern War. Fairfax, Virginia: Hero Books, 1990

U.S. Department of the Army. Health Service Support in a Theater of Operations, Field Manual 8-10. Washington, D.C.: 1 March 1991.

Grady, John E. "Army Physicians make Electronic House Calls." ARMY (February 1995): 39-40.

Gourley, Scott R. "LSTAT WILL SAVE LIVES." ARMY (March 1997): 25-26

Hartzog, GEN William W and Canady, Susan "Creating Army XXI." ARMY (October 1996): 53.

"Human Factors in Tele-Inspection and Tele-Surgery," Defense Science Office/ Defense Advanced Research Projects Agency, available from http://www.sainc.com/arpa/abmt/mithuman.htm; Internet, accessed 14 March 1997.

LaNoue, LTG Alcide M. "Army Medicine: Caring Beyond the Call of Duty." ARMY (October 1996): 151-157.

LaNoue, LTG Alcide M. " DCA Conference Briefing Slides" (29 November 1995).

"Life Support for Trauma and Transport (LSTAT)," Defense Science Office/Defense Advanced Research Projects Agency, available from http://www.sainc.com/arpa/abmt/lstat.htm; Internet, accessed 14 March 1997.

"Medical Re-Engineering Initiative," AMEDDC&S Briefing Slides (September 1995).

" Medical Re-Engineering Initiative prepares AMEDD to serve next generation Army." The Mercury (September 1996): 6-7.

"Medicine In The Gulf War." U.S. Medicine 27, no. 15 and 16 (August 1991): 1-115.

Miles, Donna "Medicine by Monitor." Soldiers (October 1994) 32-35.

" Mobile Medic Mentoring Vehicle (M3V)." DoD Telemedicine-MATMO Projects (29 August 1996). Available from http://www. matmo. army.mil/pages/m3v/m3v.html; Internet, accessed 14 March 1997.

"Personnel Status Monitor System," Defense Science Office/ Defense Advanced Research Projects Agency, available from http://www.sainc.com/arpa/abmt/index.htm; Internet, accessed 14 March 1997.

Reimer, GEN Dennis J. "The U.S. Army:'The World's Premier Force." ARMY (October 1996): 22.

Reimer, GEN Dennis J. "Soldiers are our Credentials." MILITARY REVIEW (September-October 1995): 4-15.

Steinweg, Kenneth K. "Dealing Realistically with Fratricide". Parameters xxv no.1 (Spring 1995): 26

"Teleconsultation Force XXI." AMEDD Center and School Battle Lab Home Page. Available from http://www.acs.amedd.army.mil/forcexxitelecons.htm; Internet, accessed 27 December 1996.

"Telemedicine Communications Rescue Battlefield Casualties." Signal (June 1995)

"Telementoring Force XXI." AMEDD Center and School Battle Lab Home Page. Available from http://www.acs.amedd.army.mil/forcexxitelement.htm; Internet, accessed 27 December 1996.

U.S. Army Medical Department Board, " Advanced Warfighting Experiment of Telemedicine (9602)," Force Development Evaluation Report, February 1996, v,vii,viii.

U.S. Army Medical Department Board, Force Development Evaluation Report: Advanced Warfighting Experiment of Telemedicine (9602). Fort Sam Houston, Texas: February 1996.

U.S. Department of Defense. Emergency War Surgery. Washington, D.C.: United States Government Printing Office, 1988.

U.S. Department of Defense, Final Report to Congress-Desert Storm, Appendix M, 592-594.

U.S. Department of the Army. The Medical Company, Field Manual 8-10-1. Washington, D.C.: 29 December 1994.

Zajtchuk, BG Russ and Sullivan, GEN Gordon R. "Battlefeild Trauma Care: Focus on Advanced Technology." Military Medicine 160 (January 1995): 1-7.